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The Learning Environment.

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The basic factors in personal comfort, the nature of the processes of teaching and learning, and the effects of environment on these functions are discussed. The role of climate conditioning and space conditioning as interpreted by sensory factors during the learning process gives guidelines for design solutions. Technical supplements on climate and space conditioning are planned for the future. (JS)

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This booklet has been prepared by the Perkins & Will Partnership at the request of the American Electric Power System Companies.

It discusses, in a general way, the factors you will want to consider in planning for a new school for your community.

We hope it will be of service to you in that demanding task.

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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the learning environment

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THIS REPORT IS ABOUT SCHOOLS

This report is about schools. It is mostly about buildings, but more importantly, it is about what goes on in school buildings. Its purpose is to analyze the design and construction of schools in terms of the environment they create for learning. It also suggests ways in which the student's tasks of learning and the teacher's job of educating can be made more efficient, more effective, and even more pleasant by designing schools with totally controlled environments.

The study has been prepared to help School Boards, Administrators, Architects and Engineers to decide how to plan schools to serve best the educational programs of their communities.

This brochure discusses the basic factors involved in personal comfort, the nature of the processes of teaching and learning, and the effects of environment on these functions. It likewise presents some of the main reasons for comfort conditioning in schools, from the point of view of both the Board of Education and the School Administrator.

Supplementary studies will deal with the technical aspects of school construction: matters of architectural planning and design, materials and colors, systems for heating, cooling and ventilation, and installations for lighting and power. Included will be reports on costs—both of construction and operation—of environment controls in schools.

This series is presented as a contribution toward the creation of the best possible learning environment for our children through the imaginative use of electrical energy.

CLIMATE CONDITIONING

HEATING

COOLING

VENTILATION

LIGHTING

ACOUSTICS

SPACE CONDITIONING

COLOR

FORM

FRESH AIR

factors affecting taste, smell, sight, hearing, touch

FILTERING

PURIFYING

EXHAUST

the learning environment/

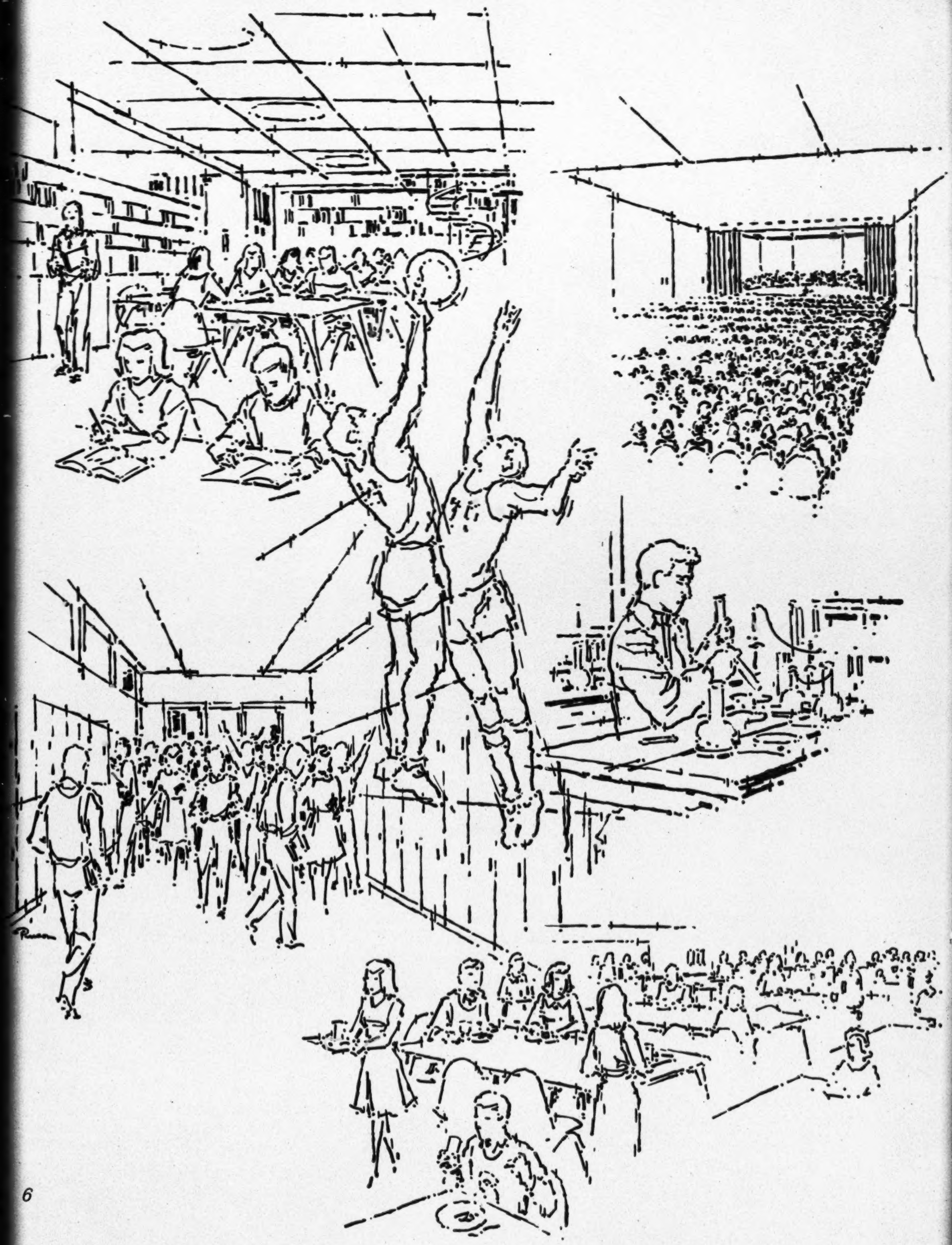
sensory factors/

We know from experience that any task can be accomplished more quickly, better and with less fatigue if surrounding conditions are right for the job. All five of our senses tell us—sometimes promptly and emphatically, often in quite subtle ways—when conditions are wrong.

Our body knows instantly if it is too warm or too cool for the activity we are engaged in, and whether or not the air we breathe is fresh, clean and comfortably humidified. Seeing tasks are made easier—and safer—with illumination of proper intensity and absence of glare. We react psychologically to colors. Bright, warm colors cheer and stimulate us. Cool, soft colors have a quieting effect. Hearing can be pleasant when desired sound comes to us clearly and with adequate strength. Noise and unwanted sound—even music—is disturbing when it intrudes upon concentration.

These senses are our means of perceiving the conditions of our environment—of measuring our degree of comfort. Physical comfort is an essential condition for effective learning and this environment is an important force affecting our attitudes, our work, our lives.

Today we possess the technical knowledge and skills, and the materials, equipment and power to design and construct the environment most suitable for any task or occupation. It is mandatory that we use this knowledge and skill to create for our children the best possible environment for learning.



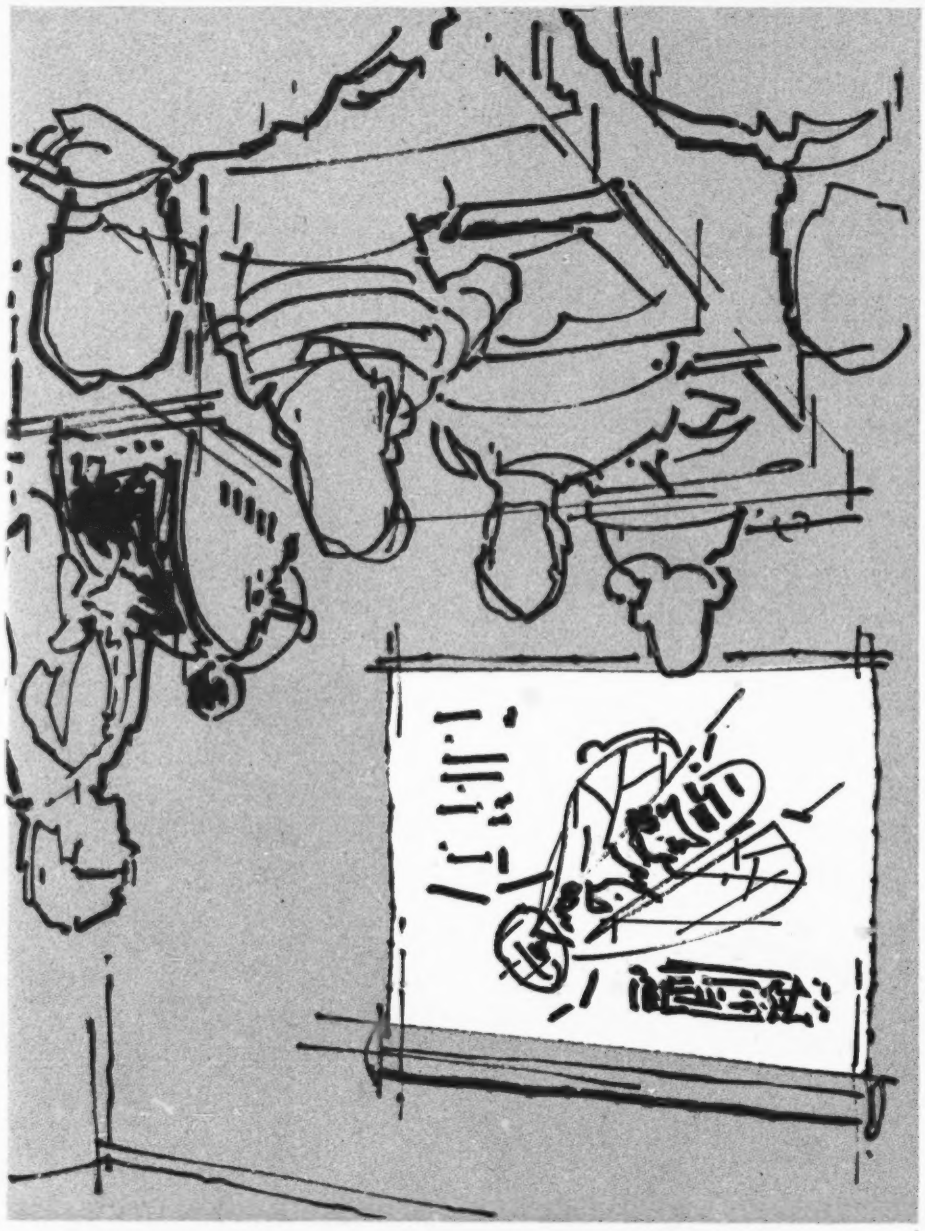
the learning process

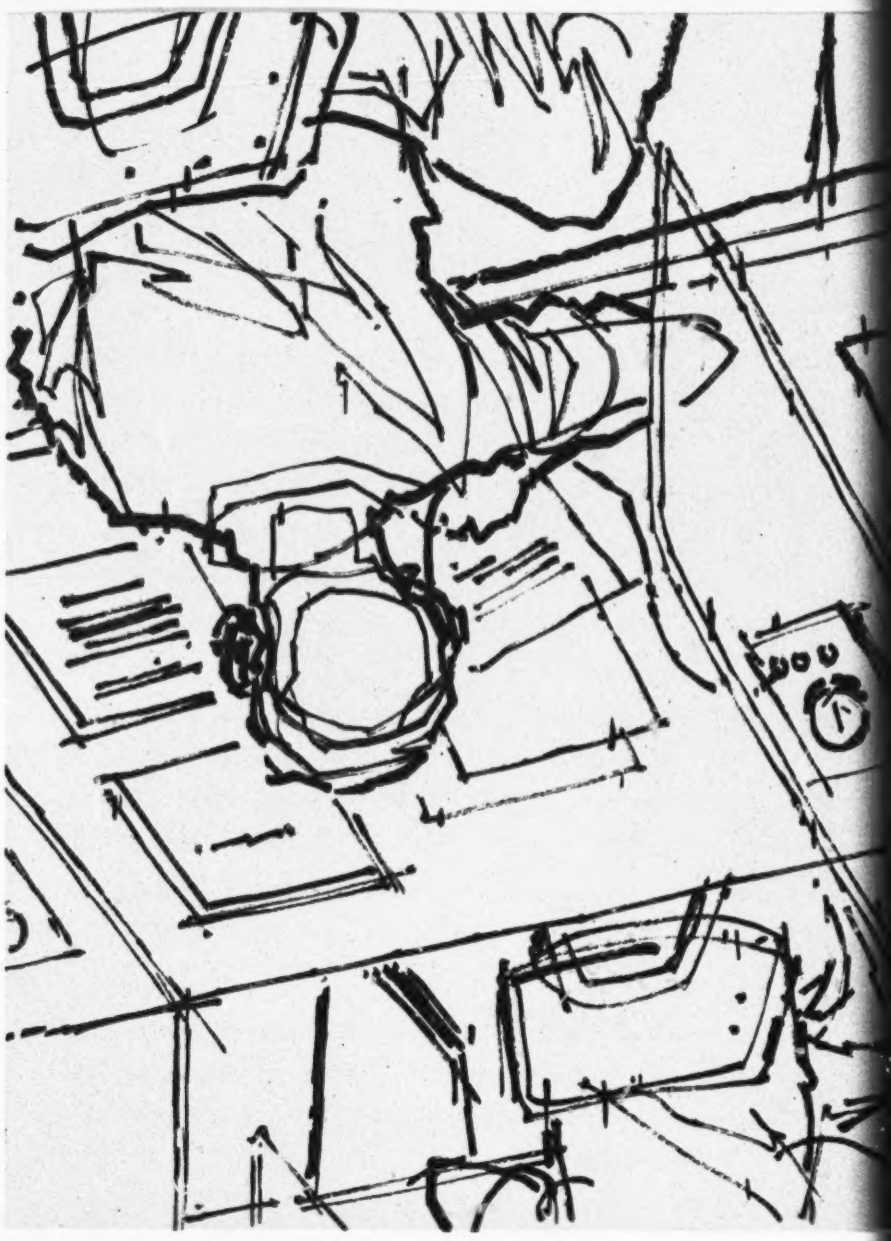
We learn in many ways—not all of which involve classrooms, teachers, or even books. In a typical situation, we are in a classroom with our minds at work on words spoken or words printed.

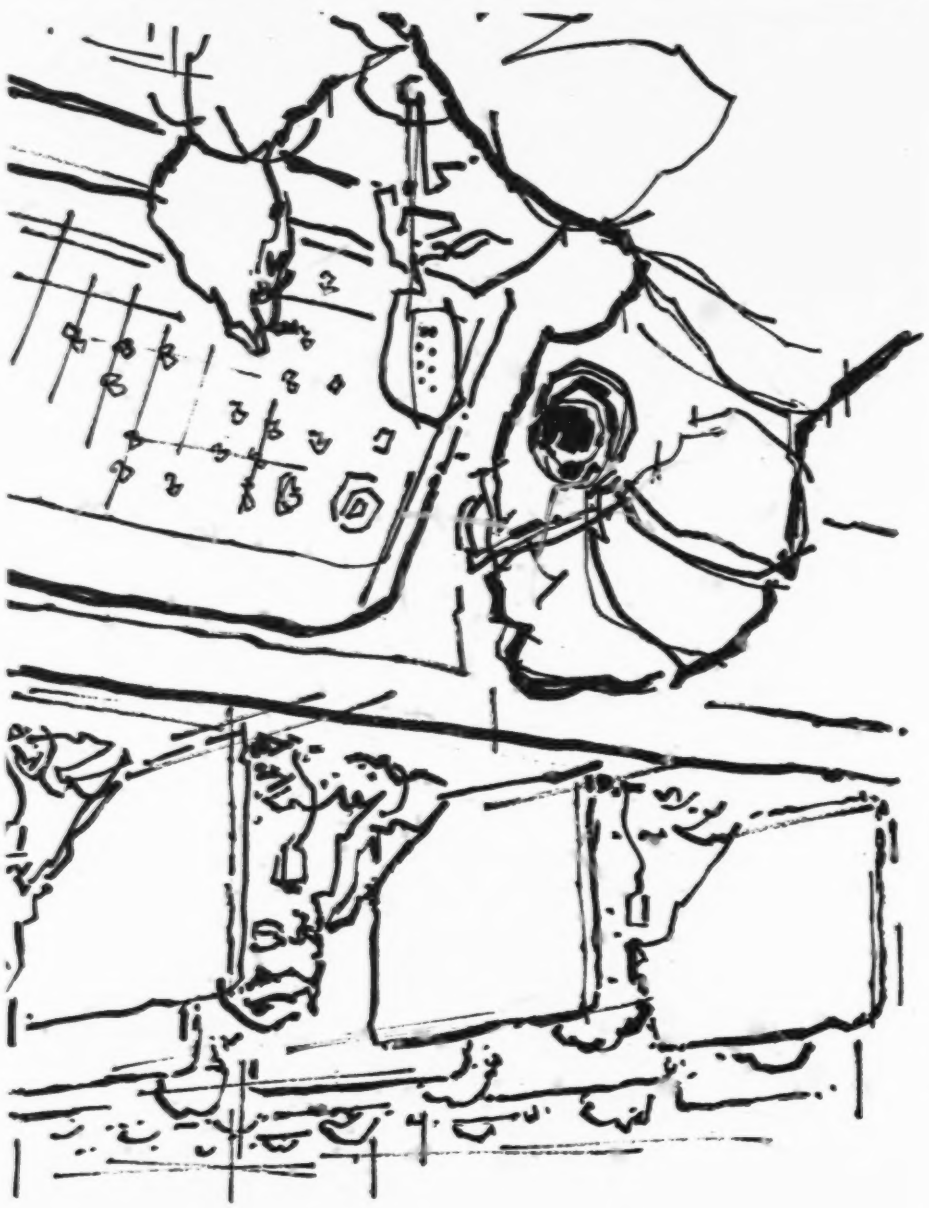
Besides these mental processes of learning, which require an environment to stimulate primarily the senses of seeing and hearing, we learn by doing. Laboratories, shops, the gymnasium require a different set of environmental controls to suit the active side of learning. High-level illumination is needed for the precise seeing called for in reading a chemical balance or a vernier caliper. Working areas of machine tools should be not only well lighted, but painted to warn of danger spots.

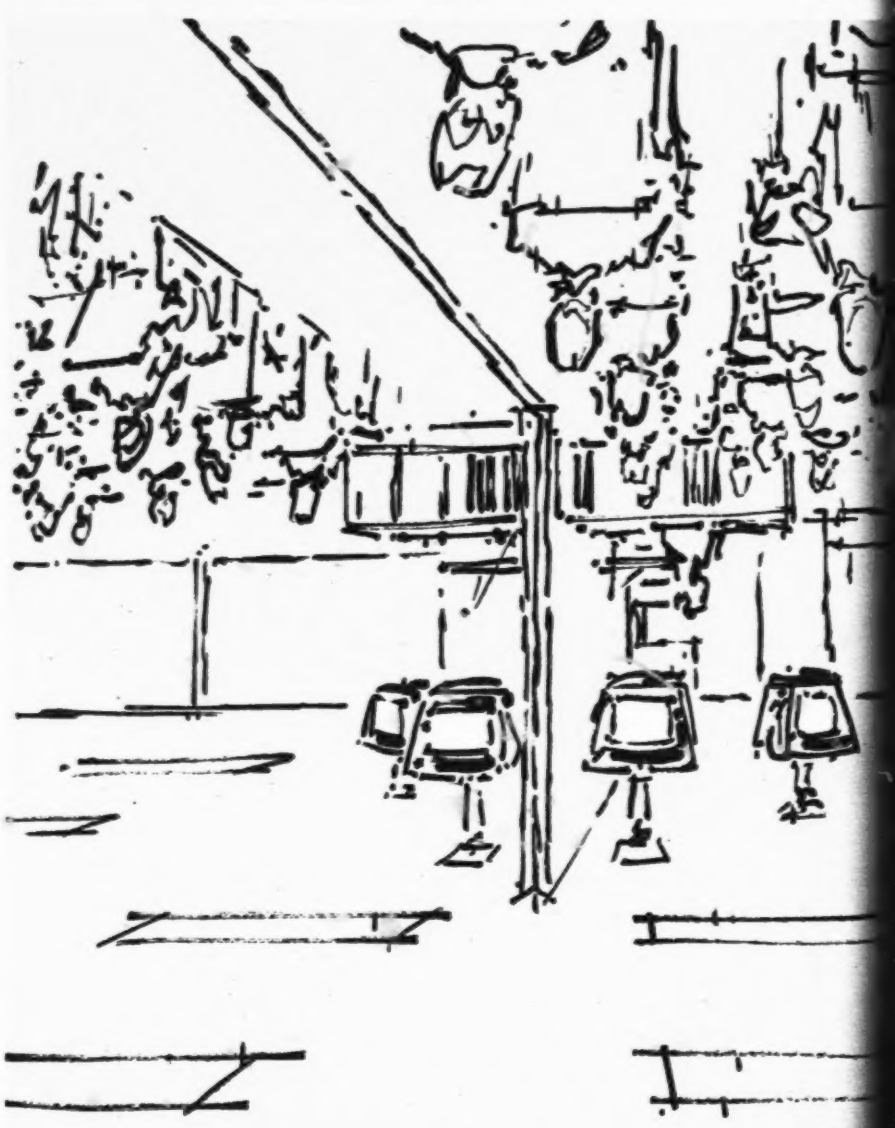
Ventilation must be provided to remove the odors of chemistry laboratories and gymnasium locker rooms—in fact, most building codes require it. Even the smells of food emanating from the lunch room kitchen can be distracting if they are spread throughout the building. Most of these rooms which house physically active learning are comfortable at somewhat lower temperatures. Those which accommodate large numbers of people, such as the gymnasium and auditorium, need positive cooling during warm months.

The kind of learning which occurs outside the classroom takes place, for example, in corridors where students gain, through their own experience and the example of others, a sense of responsibility for being on time to classes, for keeping their locker neat, for courteous conduct. In the cafeteria, table manners are learned. These steps in personal development toward maturity can take place, that is, if good lighting, cheerful colors, and acoustical treatment are present to create an environment which itself generates attitudes of respect and decorum.









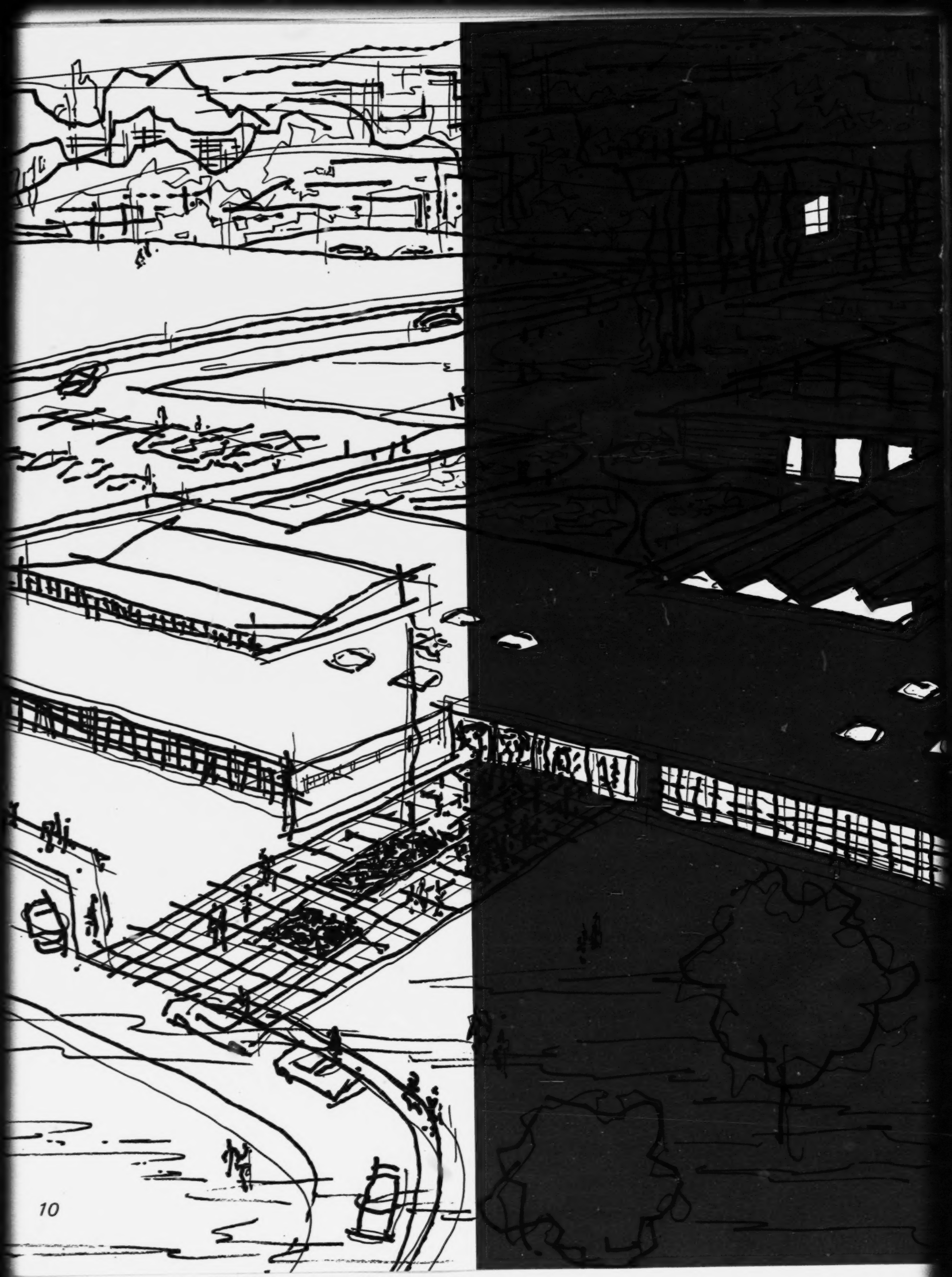
teaching techniques

The teaching profession is facing its greatest challenge: to convey an explosively growing store of knowledge to greater numbers of students with proportionately fewer teachers than ever before. Some direct answers to this challenge are emerging in the form of teaching tools and methods designed to multiply the teacher's capacities, and to accelerate the learning process.

Language laboratories with elaborate electronic equipment have become practically standard in contemporary schools. Sophisticated teaching machines help students to advance without constant teacher attention. Closed circuit television enables a few gifted teachers to reach many groups of students simultaneously.

Modern teaching techniques, such as the "core curriculum" and "team teaching" methods are creating requirements for large, flexible rooms in which to teach. They also call for separate offices and work rooms for preparation. At the same time, greater emphasis on independent study calls for provision of large numbers of individual spaces where the student advances at his own pace.

It should be evident that to make these complex methods and machines truly effective servants of the educational program, teachers themselves must be able to function efficiently. Their ability to do so depends to a very large degree upon the quality of the teaching environment. Such variety in the size and equipment of teaching spaces demands a range of equally versatile machinery to provide optimum convenience and comfort, from properly located electrical outlets to air conditioning systems which can heat some rooms of the building while cooling others.



opportunities for learning

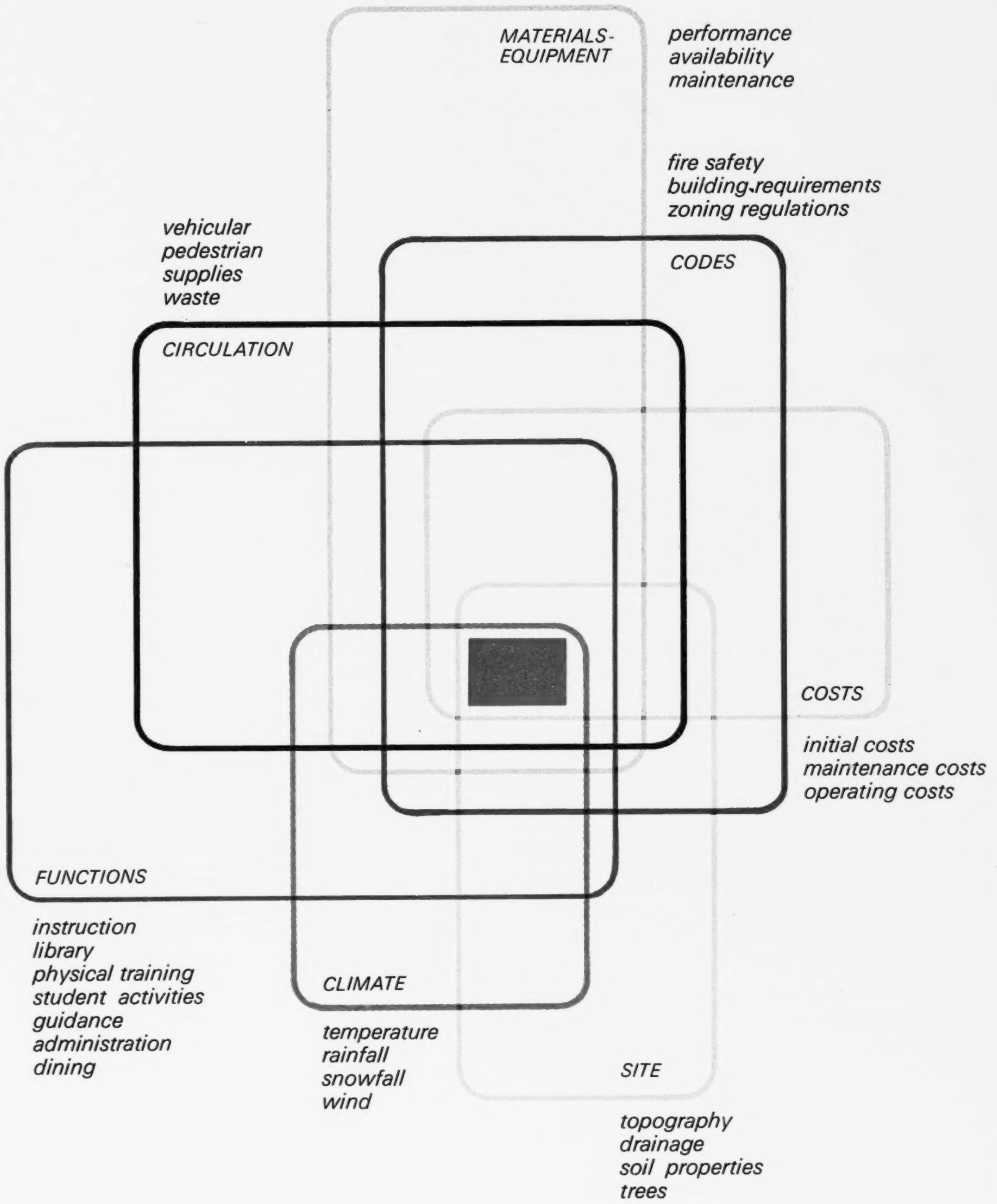
The intensified academic programs necessary today force the typical nine-month school year to be extended, and the school day to be lengthened. Summer sessions are becoming conventional both for make-up work and for acceleration and enrichment programs. Extra-curricular activities, most of which are offshoots of formal scholastic work, such as foreign language and science clubs, school publications, special music groups and dramatic organizations, are carried on into after-school hours and evenings.

In addition to housing the regular school programs, the building must accommodate adult evening classes, PTA meetings, and public lectures, concerts, and similar educational-cultural events. Add to these a variety of civic functions, such as town meetings and park recreation projects, and we have the picture of a typical school busily serving as its community's educational and cultural center practically around the clock and all year long.

Year-'round school is a fact in a few communities, and is under serious consideration in others, as a device to reduce the outlay for additional school plant. In many instances, summer sessions are being conducted in spite of the absence of cooling systems, but more often, these buildings lie dormant because boards of education are unwilling to ask teachers and students to function in "super-heated" buildings.

Thus it becomes evident that controlled learning environment not only makes for effective learning and teaching, but it also increases the opportunities for learning, and for community enrichment as well.

FACTORS AFFECTING ENVIRONMENT IN THE DESIGN OF A SCHOOL BUILDING



design of the learning environment

Architecture must have its roots in the behavioral sciences, because buildings are for people, and the architect's fundamental concern must therefore be for people's reactions to space, sound, color, heat and light. We all recognize these as basic elements to be dealt with in creating the ideal environment for learning.

There are, in addition, certain "practical" matters which the architect and engineer together must take into account in the process of designing the truly comfort-conditioned school. The diagram on the opposite page represents the factors, each of which bears on some aspect of environment, that must be woven into the design in order to produce a balanced functional building.

The most important influence upon the organization, and hence the form, of the building is the factor labeled "functions." This is the educational program for the school, and it includes also the philosophical attitudes and policies of the superintendent and board of education which guide the process of learning, their adopted methods of teaching, and standards for optimum sizes of class groups and room areas.

Finally, the building's design must be conceived not only as a practical, efficient response to these criteria of today, but it must look also to the future—anticipating the inevitable changes in teaching technologies by incorporating maximum potential for adaptability.

The summation of the architect's efforts is (or should be) a building which gracefully fits its site, expresses attractively the functions of education which it serves, and not only encompasses, but is of itself a palpable environment for learning.

CLIMATE CONDITIONING

climate conditioning/

The ability of students and teachers to perform well and effectively their respective tasks is in a large measure dependent on their state of bodily comfort, which is affected by heating, cooling and ventilation.

Heating/ *Some heating is necessary in nearly all climates. A school heating system should first have the capacity to maintain comfortable interior temperatures regardless of outdoor conditions. Secondly, the system must be flexible—capable of being controlled within each individual space, because lighting, teaching equipment, and the occupants themselves contribute heat, and, therefore, the heating for the room must be variable to suit changing conditions of occupancy. It is important to distribute heat evenly.*
The method most often used locates the sources of heat on outside walls, particularly under windows, where they counteract directly the chilling effect of cold surfaces and potential drafts.

Cooling/ *The heat of the sun, and that generated by lighting, machines and people within a building, plus high humidity, generate the kind of discomfort that robs us of energy, makes us inattentive, drowsy, irritable. To create an environment that is conducive to effective learning, surrounding air and objects must be cooled, and excess atmospheric moisture must be removed to speed the rate of evaporation from our bodies.*

Today, there are many types of equipment and systems for cooling available to the designers of schools, ranging from individually-controlled, self-contained, single-room units to central systems. There are electrically driven compressor cooling systems (far in the majority), and there are heat pumps, which provide both heating and cooling. Some installations operate using the heat piping system to distribute chilled water. The most advanced is the total-electric concept which combines heating and cooling, utilizes the heat of light, and employs practically every kilowatt of electrical energy brought into the building in the service of the learning environment.

Ventilation/ *Complete control of the learning environment requires conditioning of the air in the school—the removal of stale, odor-laden air, and circulation of fresh, cleaned air, tempered to suit the conditions required in each space.*

The circulation system must be such that the air is diffused as it enters the room, and does not create drafts. It also must move the air at velocities which will not create distracting noise. There must be controls to permit adjusting the quantity of air in accord with varying space sizes and occupancies.

The choice of the appropriate climate conditioning systems for the learning environment is a complex matter which is treated in full detail in a special supplement.

LIGHTING
ACOUSTICS
COLOR
FORM

space conditioning/

Skillful use of lighting, acoustics, color and form in school design is an essential ingredient of conditioning space in the learning environment. These are the environmental elements which, properly applied, act upon our senses of sight and hearing to cause reactions conducive to learning and teaching.

Lighting/ *Good lighting design involves locating illumination sources so that work areas receive adequate light, free of glare and excessive contrast or shadow. Both natural and artificial light must be controllable to eliminate glaring shafts of sunlight, or to darken the room for projecting pictures. Incandescent lighting is preferable in dining areas, because it makes food look most appealing and appetizing. It is also desirable to use some incandescent lighting, strategically placed, to create points of accent in the conventional all-fluorescent systems.*

Acoustics/ *Acoustical control involves containment, absorption and reflection, or reinforcement of sound. According to the circumstances of the listener, we must prevent sound from leaving a space when it will disturb people in adjacent rooms; a certain amount of acoustically absorbent material must be used to "soak up" noise in such areas as corridors and cafeterias; accurate and comfortable hearing of music in an auditorium depends on projecting the sound for reflection from some surfaces, but absorption in others to prevent distracting echos; a speaker's voice may have to be reinforced by an amplifier in large rooms.*

Colors/ *Color is a psychological aid to learning. Tastefully used, it can enhance environment, engendering a cheerful, receptive mood. Bright, warm colors stimulate excitement and action in the gymnasium; soft, cool colors create a quiet atmosphere in places of study.*

Form/ *The physical shapes of our surroundings likewise have psychological effects which can favorably influence learning. Large rooms, such as the library, cafeteria, or auditorium require higher ceilings, for a sense of airy freedom, than do small offices and conference rooms; corridors should be offset, and widened occasionally to avoid the feeling of interminable constricting length; an atmosphere of spaciousness, or lack of confinement, can be created by making some interior partitions of glass.*
The design of these aspects of space conditioning is discussed at greater length in one of the supplements to this presentation, together with a broad review of total planning and architectural design of environment-conditioned schools.

economics of comfort conditioning

This discussion might better be headed "economies" rather than "economics," for in the totally comfort-conditioned environment, there are such economies. Business and industry have amply proved that people perform more efficiently in ideally controlled surroundings, and—equally well supported—is the fact that financial economies are also evident.

Translating these arguments to the school situation, it can be said that if students learn and teachers instruct more efficiently in a controlled learning environment, more students can be educated in less time, hence at a lower cost per student. If the building is conditioned for effective 12-month operation, or at least summer sessions, and if it is thus attractive for intensive community use, it can certainly be said to be efficiently, and hence economically, used.

Certain characteristics of building designs appropriate to total environment conditioning may, if the educational program permits, militate toward more economical construction, particularly if full, imaginative use is made of the flexibility of electrical energy. The compact plan, for example, produces minimum exterior wall area, reduces piping runs, uses corridors and service areas most efficiently and can be substantially more economical to build, operate and maintain than other plan arrangements.

These discussions are intended to touch only the highlights of reasons for comfort conditioning in schools. The main purposes are to underscore the critical need for the highest possible quality of instruction and the most effective learning in today's complex, competitive society—and to demonstrate the significant part environment plays in attaining such ideals.

More—and better—use of school buildings is, in itself, an economy to the community. Add to this the broadened educational and cultural advantages to the community at large, and it becomes apparent that the totally comfort-conditioned school is both practical and necessary.

We are dealing with the future of our children and our own standards and ideals. Time is youth's most valuable asset. It is our responsibility to see that this time is spent most efficiently. Therefore, we cannot think in terms of less than the best environment for learning.

TECHNICAL SUPPLEMENTS:

Technical Supplements on Climate Conditioning (heating, cooling and ventilation) and Space Conditioning (architectural planning, design, lighting and equipment) will go into greater detail to help further the creation of the best possible learning environment.

"The learning years are priceless . . . we must all recognize and meet the challenge!"

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